

In the Claims

The claims pending in the application are as follows:

1 1. (previously presented) A method of improving adhesion between an
2 insulating layer and a capping layer in a process for making electronic components
3 comprising:

4 providing an integrated circuit structure which is in the process of being

5 fabricated into a finished electronic component having an insulating layer;

6 contacting an exposed surface of said insulating layer with a gas selected from

7 the group consisting of silane, disilane, dichlorosilane, germane and

8 combinations thereof for adsorption of said gas onto said exposed surface

9 of said insulating layer to form a treated surface area of said insulating layer

10 while maintaining an original thickness of said insulating layer;

11 depositing a capping layer directly over said treated surface area of said

12 insulating layer; and

13 continuing the process for making the integrated circuit device,

14 wherein said treated surface area of said insulating layer improves adhesion

15 between said insulating layer and said capping layer to prevent delamination

16 therebetween during said step of continuing the process for making the integrated

17 circuit device.

1 2. (original) The method of claim 1 wherein said insulating layer has a

2 thickness ranging from about 2,000 Å to about 10,000 Å.

1 3. (original) The method of claim 1 wherein said insulating layer comprises a
2 low k dielectric.

1 4. (original) The method of claim 3 wherein said low k dielectric comprises a
2 material selected from the group consisting of organo silicate glass, polyimide,
3 organic siloxane polymer, polyarylene ether, methyl hydrogen, nano-porous silica,
4 hydrogen silesquioxane glass and methyl silesquioxane glass.

1 5. (cancel)

1 6. (original) The method of claim 1 wherein said adsorbed gaseous particles
2 selected from the group consisting of molecules, radicals, derivatives and
3 combinations thereof of said gas are adsorbed onto said exposed surface of said
4 insulating layer to form said treated surface area.

1 7. (original) The method of claim 6 wherein said adsorbed gaseous particles
2 are adsorbed onto said exposed surface of said insulating layer by heating said
3 integrated circuit having said insulting layer to a temperature ranging from about
4 100°C to about 500°C and then flowing said gas over said exposed surface of said
5 heated insulating layer.

1 8. (currently amended) The method of claim 7 wherein said gas is flown over
2 said exposed surface of said heated insulating layer at a pressure ranging ~~from~~from
3 about 0.5 Torr to about 10 Torr for a duration of about 50 sccm to about 500 sccm.

1 9. (previously presented) A method of forming a semiconductor device
2 comprising:

3 providing a substrate layer;

4 depositing an insulating layer over said substrate layer;

5 heating said substrate layer and said insulating layer;

6 flowing a treatment gas selected from the group consisting of silane, disilane,
7 dichlorosilane, germane and combinations thereof over a surface of said
8 heated insulating layer;

9 contacting said surface of said heated insulating layer with said treatment gas
10 for adsorption of said gas onto said surface of said insulating layer to form
11 a treated surface area of said insulating layer while maintaining an original
12 thickness of said insulating layer; and

13 depositing a capping layer directly over said insulating layer wherein said
14 treated surface area of said insulating layer improves adhesion between
15 said insulating and said capping layers to prevent delamination
16 therebetween during subsequent processing steps.

1 10. (original) The method of claim 9 further including the step of depositing a
2 dielectric layer over said substrate layer followed by depositing said insulating layer
3 over said dielectric layer.

1 11. (original) The method of claim 10 wherein said dielectric layer is deposited
2 to a thickness ranging from about 300 Å to about 800 Å.

1 12. (original) The method of claim 9 wherein said insulating layer comprises a
2 low k dielectric selected from the group consisting of organo silicate glass,
3 polyimide, organic siloxane polymer, polyarylene ether, methyl hydrogen, nano-
4 porous silica, hydrogen silesquioxane glass and methyl silesquioxane glass.

1 13. (original) The method of claim 12 wherein said insulating layer is deposited
2 to a thickness ranging from about 2,000 Å to about 10,000 Å.

1 14. (original) The method of claim 9 wherein said substrate layer and said
2 insulating layer are heated and maintained at a temperature ranging from about
3 100°C to about 500°C.

1 15. (original) The method of claim 9 wherein said adsorption of said gas onto
2 said surface of said insulating layer comprises adsorbed gas particles selected from
3 the group consisting of gaseous molecules, radicals, derivatives thereof and
4 combinations thereof.

1 16. (cancel)

1 17. (previously presented) The method of claim 9 wherein said treatment gas is
2 flown over said surface of said heated insulating layer at a pressure ranging from
3 about 0.5 Torr to about 10 Torr.

1 18. (original) The method of claim 17 wherein said treatment gas is flown over
2 said surface of said heated insulating layer for a duration of about 50 sccm to about
3 500 sccm.

1 19.-20. (cancel)

1 21. (original) The method of claim 9 wherein said capping layer is selected from
2 the group consisting of silicon oxide, silicon carbide and silicon nitride.

1 22. (original) The method of claim 9 wherein said subsequent processing steps,
2 further including the steps of:

3 forming a first set of openings in a first mask deposited over said capping
4 layer;

5 transferring said first set of openings into said insulator layer to form via
6 openings in said insulator layer;

7 depositing photo resist in an amount sufficient to at least fill said via openings
8 in said insulator layer; and

9 etching back said photo resist so as to leave remaining portions of said photo
10 resist only within said via openings to form photo resist plugs in said
11 insulator layer.

1 23. (original) The method of claim 22 further including the subsequent steps of:
2 forming a second set of openings in a second deposited mask directly over
3 said via openings;
4 transferring said second set of openings into said insulator layer to form trench
5 openings over said via openings in said insulator layer;
6 removing said photo resist plugs to expose a metal region of said substrate
7 layer;
8 depositing a metallization layer in an amount sufficient to at least fill said via
9 openings and said trench openings; and
10 planarizing a surface of the semiconductor device wherein said treated
11 surface area of said insulting layer prevents delamination between said
12 insulating layer and said capping layer.

1 24.-29. (Cancel.)

2 30. (previously added) A method of forming a semiconductor device
3 comprising:
4 providing a substrate layer;
5 depositing an insulating layer over said substrate layer;

6 heating said substrate layer and said insulating layer;
7 flowing a treatment gas over a surface of said heated insulating layer;
8 contacting said surface of said heated insulating layer with said treatment gas
9 for adsorption of said gas onto said surface of said insulating layer to form
10 a treated surface area of said insulating layer while maintaining an original
11 thickness of said insulating layer;
12 oxidizing said treated surface area of said insulating layer; and
13 depositing a capping layer directly over said insulating layer wherein said
14 treated surface area of said insulating layer improves adhesion between
15 said insulating and said capping layers to prevent delamination
16 therebetween during subsequent processing steps.

1 31. (previously added) The method of claim 30 wherein said treatment gas is a
2 silane-based gas.

1 32. (previously added) The method of claim 30 wherein said treatment gas is a
2 germanium-based gas.

1 33. (previously added) A method of forming a semiconductor device
2 comprising:

3 providing a substrate layer;
4 depositing an insulating layer over said substrate layer;
5 heating said substrate layer and said insulating layer;

6 flowing a treatment gas over a surface of said heated insulating layer;
7 contacting said surface of said heated insulating layer with said treatment gas
8 for adsorption of said gas onto said surface of said insulating layer to form
9 a treated surface area of said insulating layer while maintaining an original
10 thickness of said insulating layer;
11 carbonizing said treated surface area of said insulating layer; and
12 depositing a capping layer directly over said insulating layer wherein said
13 treated surface area of said insulating layer improves adhesion between
14 said insulating and said capping layers to prevent delamination
15 therebetween during subsequent processing steps.

1 34. (previously added) The method of claim 33 wherein said treatment gas is a
2 silane-based gas.

1 35. (previously added) The method of claim 33 wherein said treatment gas is a
2 germanium-based gas.